



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/674,631	09/29/2003	Shashank C. Deshmukh	8233/ETCH/SILICON/JB	4703

55649 7590 07/06/2006

MOSER IP LAW GROUP / APPLIED MATERIALS, INC.
1040 BROAD STREET
2ND FLOOR
SHREWSBURY, NJ 07702

EXAMINER

UMEZ ERONINI, LYNETTE T

ART UNIT	PAPER NUMBER
----------	--------------

1765

DATE MAILED: 07/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/674,631	Applicant(s) DESHMUKH ET AL.	
	Examiner Lynette T. Umez-Eronini	Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 March 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 and 32-43 is/are pending in the application.
- 4a) Of the above claim(s) 22-41 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-21, 42 and 43 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Specification

1. The amendment filed 3/14/2006 is objected to under 35 U.S.C. 132(a) because it introduces new matter into the disclosure. 35 U.S.C. 132(a) states that no amendment shall introduce new matter into the disclosure of the invention. The added material that is not supported by the original disclosure is as follows: "wherein the pre-selected wavelength in nanometers is greater than or on the order of the initial thickness of the initial thickness of the material in Angstroms" is not supported by the Specification [0018].

Applicant is required to cancel the new matter in the reply to this Office Action.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1-21, 42, and 43 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. In claim 1, lines 8-10 "wherein the pre-selected wavelength in nanometers is greater than or on the order of the initial

Art Unit: 1765

thickness of the initial thickness of the material in Angstroms" lacks support in the Specification [0018].

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1- 5, 7, 8, 9, 10, and 42; 11, 12, 14, 15, 16, 18, 19, 20, 21 and 43 are rejected under 35 U.S.C. 102(b) as being anticipated by Lee et al. (US 5,835,221).

Lee discloses a method used to monitor film thickness. Polarized light is made incident on the surface of a substrate with a film thereon that has a different reflectivity than that of an underlying substrate. The substrate is subjected to conditions that change the thickness of the film on the substrate. The polarized light that is reflected from the substrate is detected at a selected wavelength or wavelengths and a trace of the intensity of the reflected light both parallel and perpendicular to the substrate surface overtime is obtained (Abstract). Lee further discloses the etching endpoint are identified by the cessation of oscillation or a change in slope of ellipsometric parameters in time as describe in US Patent 5,494,697, to Blayo et al., which is incorporated by reference.

Lee further discloses measuring the thickness of a patterned layer or layers of material on a substrate surface wherein the layers comprises 1500 Å (~150 nm) oxide

Art Unit: 1765

(same as Applicants' high-k dielectric material layer and high-k gate dielectric layer), which overlies a 1125 Å (~112 nm) TiN, and 1625 Å (~162 nm) polysilicon (column 3, lines 30-59) and which were etched at 2.0 eV, 2.8 eV, 3.3 eV, and 4.0 eV (~ 620 nm, 443 nm, 376 nm, and 310 nm). Lee also discloses an oxide mask having a thickness of 100 to 2000 Å (100-200 nm), 1000 Å thick titanium nitride formed over a 2000 Å (200 nm), polysilicon film and 70 Å (7 nm), thick gate oxide (column 7, lines 38-50).

As to claims 1-5, 7-10, and 42; 11, 12, 14-16, 18-21, and 43, the aforementioned reads λ_{on} ,

A method for determining the endpoint of an etch process, comprising:

- (a) providing a substrate comprising a material layer having an initial thickness;
- (b) etching the material layer on the substrate;
- (c) directing radiation onto the substrate as the material layer is etched;
- (d) measuring a change in intensity for radiation reflected from the substrate at a pre-selected wavelength as the material layer is etched, wherein the pre-selected wavelength in nanometers is greater than or on the order of the initial thickness of the material layer in Angstroms; and
- (e) terminating the etch step upon measuring a predetermined metric for the change in intensity radiation reflected from the substrate at the pre-selected wavelength.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 6 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. (US 5, 835,221), as applied respectively to claims 1-5 and claims 11, 12, and 14-16 Grimbergen (US 6,406,924 B1).

Lee differs in failing to teach filtering wavelength other than the pre-selected wavelength..

Grimbergen teaches an etching endpoint detection method during processing of a substrate (column 2, lines 62-65 and column 5, lines 41-43) and also teaches placing a filter in the path of the reflected radiation to allow radiation having the desired wavelength to pass through or be used.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Lee's endpoint detection method by filtering wavelength as taught by Grimbergen for the purpose of allowing radiation having the desired wavelength to pass through or be used.

9. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lee (US '221) as applied to claims 11-12 above, and further in view of Ngai et al. (US 6,518,106 B2).

Lee differs in failing to teach wherein the gate dielectric layer comprises at least one film of hafnium dioxide (HfO_2) and hafnium silicate (HfSiO_2), **in claim 13**.

Ngai teaches forming gate dielectric over a semiconductor substrate in forming a transistor and thermally growing the gate dielectric to a thickness of approximately 1 to 50 Angstroms. Ngai also teaches the gate dielectric is SiO_2 and can be an oxide such as HfO_2 (column 2, lines 34-56).

Since Ngai illustrates using SiO_2 and HfO_2 as gate dielectric is known, then it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to select HfO_2 as a gate dielectric as taught in the Ngai reference because their use is known in manufacturing of semiconductor devices such as transistors (Ngai, column 1, lines 6-9 and column 2, lines 34-56, and column 4, lines 10-12).

Response to Arguments

10. Applicant's arguments with respect to claims 1-21 and 42-43 have been considered but are moot in view of the new ground(s) of rejection because the formerly applied references failed to address:

“A method for determining the endpoint of an etch process, comprising: . . . -- wherein the material layer is a high-k dielectric material layer; . . . wherein the pre-selected wavelength in nanometers is greater than or on the order of the initial thickness of the material layer in Angstroms-- . . .” as recited in (Currently Amended) Claim 1; and

“A method for determining the endpoint of an etch process, comprising: . . . -- wherein the gate dielectric layer is a high-k dielectric layer; . . . wherein the pre-selected wavelength in nanometers is greater than or on the order of the initial thickness of the material layer in Angstroms-- . . .” as recited in (Currently Amended) Claim 11.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Rose is relied upon to show silicon dioxide has a high dielectric constant (column 1, line 50-52), thereby making it a high-k dielectric material.

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

Application/Control Number: 10/674,631

Page 9

Art Unit: 1765

USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Art Unit 1765

ltue

June 22, 2006

NADINE NORTON
SUPERVISORY PATENT EXAMINER
ART UNIT 1765
N Z